NASA STTR 2007 Phase I Solicitation

T4.01 Earth Science Sensors and Instruments

Lead Center: GSFC

As part of its mission, NASA seeks to develop a scientific understanding of the Earth system and its responses to natural and human-induced changes to enable improved prediction of climate, weather, and natural hazards for present and future generations. By using breakthrough technologies for terrestrial, airborne, and spaceborne instrumentation, we seek to observe, analyze, and model the Earth system to discover how it is changing and the consequences for life on Earth.

This STTR subtopic seeks to help provide advanced remote sensing technologies to enable future Earth Science measurements. Systems and approaches will be considered that demonstrate a capability that is scalable to space or can be mounted on a relevant platform (UAV or aircraft). New systems and approaches are sought that will

- Enable new Earth Science measurements;
- Enhance an existing measurement capability by significantly improving the performance (spatial/temporal resolution, accuracy, range of regard); and/or
- Substantially reduce the resources (cost, mass, volume, or power) required to attain the same measurement capability.

Lidar Remote Sensing Instruments

Lidar remote sensing systems are required to meet the demanding measurement requirements for future Earth Science missions. A particular emphasis is placed on instruments that can be used on UAV platforms such as the NASA Ikhana or Altair platforms. Instruments are solicited that enable or support the following Earth Science measurements:

- High spatial and temporal resolution observations of the land surface and vegetation cover (biomass);
- Profiling of clouds and aerosols, with emphasis on multiple beam systems to provide horizontal coverage;
- Wind measurements (direct-detection technology only);
- Tropospheric and stratospheric ozone and CO_2 (profiling and total column).

Active Remote Sensing Instruments (Radar) for Aircraft and Unmanned Aerial Vehicles (UAVs)

Active microwave remote sensing instruments are required for future Earth Science missions with initial concept development and science measurements on aircraft and UAVs. New systems, approaches, and technologies are sought that will enable or significantly enhance the capability for: (1) tropospheric wind measurements within precipitation and clouds at X- through W-band, (2) precipitation and cloud measurements, and (3) large aperture ground penetrating radars (GPR) at P-band and lower. Systems and approaches will be considered that demonstrate a capability that can be mounted on a relevant platform (UAV or aircraft). Specific technologies include:

- High efficiency, solid state power amplifiers (>10W at Ka-band and >30W at Ku-band);
- High performance, low power, compact, real-time radar processors, FPGA-based digital receivers, data processing algorithms and data reduction techniques;
- Implementation of radar transmitters/receivers using digital signal synthesis;
- High power, low sidelobe (better than -30 dB) scanning phased array antennas (X, Ku, Ka or W-band) for high-altitude operation (65,000 feet);
- Wide-bandwidth (>=400 MHz), high efficiency FM chirp/linear pulse signal generator with amplitude modulation; and
- High power (30W at Ka-band , 5W at W-band), high speed (=250µs), high isolation (=40 dB) and low insertion (1.5 dB at Ka and 2 dB at W-band) switch.

Data Compression

To complement data compression, data decompression processors are needed to decode compressed data streams. To target multiple missions, implementations should conform to the Consultative Committee for Space Data Systems (CCSDS, www.ccsds.org) recommendation CCDDS 122.0-B 1. This solicitation seeks development of new data decompression processors that can:

- Process instrument data at over 20 Mpixels/sec decoding rate for instruments that employ compression for either direct broadcast or during nearly real-time ground processing after telemetering the data to ground

stations;

- Decode up to 16-bit of science data; and
- Decode embedded compression bit stream following the format described in CCSDS 122.0-B.1 (www.ccsds.org).